

it was not secured, and on the 29th of the same month he secured one making his second specimen for this fall. I have never met with it in any of my collecting trips, nor has my son, nor have I ever found a light-house specimen, although I have received and examined carefully hundreds of Warblers from the lights during the past few years.

16. *Geothlypis formosa*. KENTUCKY WARBLER.—Mr. Giraud says: "The specimen in my possession was shot in the woods at Raynor South, —and a few others have been procured in the same section. On no other part of the Island have I observed it, and I consider it with us a very scarce species."* In the Lawrence collection in the American Museum, there is one specimen, a male, labelled, "Raynor South, May 18, 1834." Since the lists of Giraud and Lawrence were published no other record has been made; therefore, it gives me pleasure to record a specimen, a male, which was sent to me by Mr. Skipworth from Fire Island Light, where it struck during the night of August 19, 1888; wind west, squally, with rain and fog.

17. *Sylvania mitrata*. HOODED WARBLER.—"With us, the Hooded Flycatching Warbler is not abundant" is the note of Giraud.† In the Lawrence collection in the American Museum, there is but one specimen, a male, from Long Island. The only specimen* that I have in my collection, and also my only record from Long Island, is of one that struck Fire Island Light, during the night of September 1, 1888. Wind, N. W., light; cloudy.

GRAPHIC REPRESENTATION OF BIRD MIGRATION.

BY WITMER STONE.

EVERY ONE interested in bird migration no doubt notices the steady increase in species and individuals as the spring advances, the number reaching its maximum some time in May, and then falling off and becoming uniform during the early summer when the birds have completed their migrations and are busy building their nests and rearing their young. Again in the latter part of summer the number increases, reaches its maximum in September, and then steadily decreases until winter, when the minimum is reached.

*Birds of Long Island, p. 50.

†Ibid., p. 48.

I have always desired to collect sufficient data to form some definite idea of this rate of increase and decrease during the different seasons of the year; and for some years past have conducted observations chiefly with this end in view. To estimate the number of individual birds in a given locality at any time, especially during the migrations, is wellnigh impossible, and therefore the only investigations that could be carried on were with regard to the number of species. Living in a locality favorable for ornithological investigations I have noted for several years the species of birds seen on each day from January to June inclusive, and, with the assistance of several others interested in the subject, have accumulated a considerable amount of data. On some days in winter no birds were observed at all,—the English Sparrow of course excepted—on other days perhaps only a Snowbird or a Crow was recorded. In spring, too, on rainy days the number of species noted was very small, while on clear days when the migration was at its height upwards of fifty species were sometimes recorded on a single morning. Similar observations were carried on in the fall, but owing to the difficulty in recognizing many species at that season on account of the thick foliage of the trees, the results were much less accurate and therefore less interesting.

While I said above that an estimate of the number of individuals was hardly possible, this is perhaps not strictly the case. For, as the number of individuals of a given species increases, the probability of seeing that species every day increases, and hence by taking an average of the number of species seen per day for each consecutive week, the results obtained must show an increase in regard to individuals as well as species. Moreover, the comparison of the total number of species seen in each consecutive week would show the increase in regard to species alone.

After noting the dates of arrival and departure of each species seen during the year, the result may be represented as in Fig. 1 (a small portion of the spring migration, 1888, at Germantown, Pennsylvania), the horizontal lines representing the time of the birds' stay, and the vertical columns the consecutive weeks. The horizontal lines represent, of course, only the probable continuous presence of a species, for very few birds are actually seen every day from their arrival to their departure. Now by counting the number of lines crossing a given column it is easy to see

the number of species that occurred in the locality during that week. And a curve constructed from these results (Fig. 2, A) will show the variation in the number of species during the period that the investigations cover. By using the actual number of

Jan. 1	9	17	25	Feb. 1	8	15	22	Mar. 1	9	17	25	Apr. 1	8	16	24	May 1	9	17	25	June 1	8	15					
				<i>Corvus americanus</i>																							
								<i>Quiscalda quisquilla</i>																			
												<i>Sayornis phoebe</i>															
																<i>Turdus pallasi</i>											
																		<i>Chelidon erythrogaster</i>									
<i>Junco hyemalis</i>																											
																<i>Dendroica coronata</i>											
																		<i>Turdus mustelinus</i>									
																		<i>Turdus swainsonii</i>									

Fig. 1. Portion of Chart showing the birds recorded at Germantown, Pa. Spring, 1888.

species seen during each week, as recorded in the notebook, a curve may be constructed which will be quite similar though less regular, since the meteorological conditions here play an important part. For instance, on a cold or rainy week the number of species observed will be less, simply because it was impossible to make many observations. A curve (Fig. 2, C) constructed on the average number of species seen per day, for each week, will, as stated above, show the variation in regard to both individuals and species.

Looking at curve A, Fig. 2 or 3, representing the variation in the number of species recorded at Germantown, Pa., during the spring migration of 1888, we see the number at a minimum through the winter, until about the middle of February. At this time the first increase is noticed, caused by the arrival of the Grackles, Red-winged Blackbirds, Robins, and Bluebirds. Then the number is stationary until the second week of March, when a gradual increase begins which continues more rapidly during April and still more rapidly during the first week of May. The number finally reaches its maximum in the second week of that month and then decreases rapidly until it again becomes station-

ary in June. These variations represent first the arrival of such early birds as the Meadowlark, Dove, Chipping Sparrow, Field Sparrow, etc., in the middle or latter part of March; then the Kinglets, Towhee, Chimney Swift, etc., in April, and finally in May the vast influx of Warblers and other birds, many of which remain but a few days and then pass on to the north; leaving us by the second week of June with only the summer residents. The departure of the several winter visitants during March and April is more than balanced by the arrival of species from farther south.

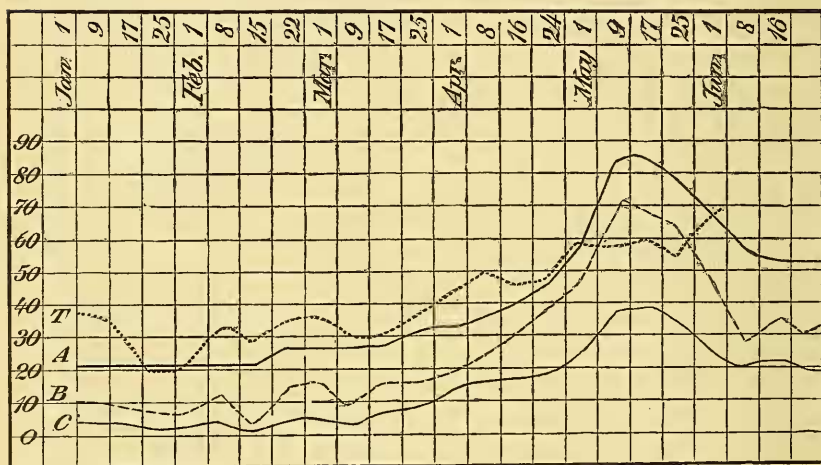


Fig. 2. Spring Migration at Germantown, Pa., 1888.

- A. Curve showing the number of species present.
- B. do. based on the *actual* number of species recorded each week.
- C. do. based on the average number of species seen per day, for each week.
- T. Curve of temperature variation, spring, 1888.

It will be seen from curve B, Fig. 2, that the number of species actually seen never equalled the number of species that were present, though it came very near it about the 1st of March and again about the middle of April. The prominent 'drops' in this curve during the winter and early spring will be found to correspond to spells of severe weather at those times.

By comparing the three curves of Fig. 3, the remarkable similarity of the spring migration for the past three years can readily be seen. The number of species seen in the different years varied considerably, but this is more a function of the time that was

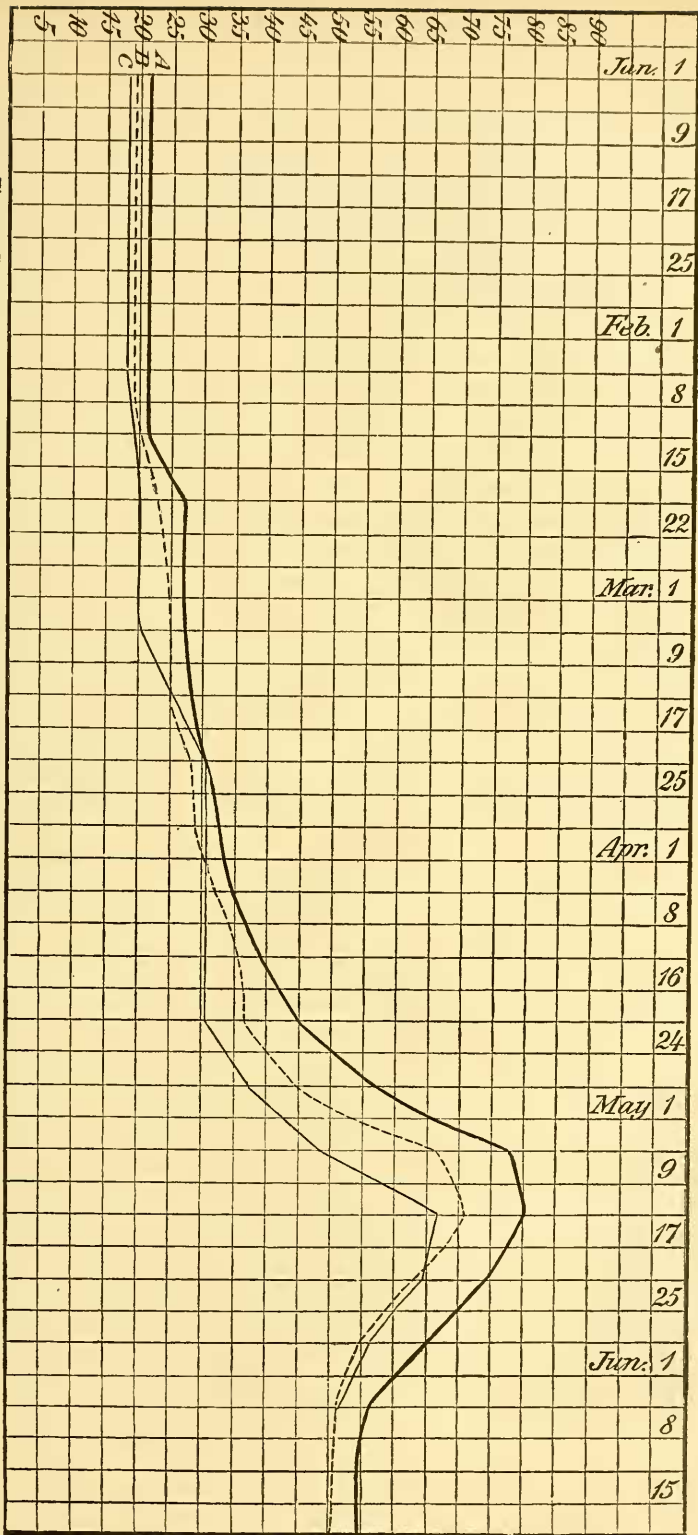


Fig. 3. Curves showing the number of species present at Germantown, Pa., during spring migration. A. 1888. B. 1887. C. 1886.

available for making the observations. The general form of the curves will be seen to be very similar; the first increase always takes place in the middle of February; and the greatest increase during the last week of April and the first week of May; while the maximum is reached in the second week of the latter month.

Finally, comparing curves A and T and B and T, Fig. 2, we see that there is no remarkable resemblance between the temperature variation and the increase in the number of species; but quite a striking resemblance between the temperature variation and the number of species actually recorded. This is especially the case during the winter and early spring when it will be noticed that almost every sudden increase in the number of species seen was accompanied by a corresponding rise in temperature, and *vice versa*.

Such investigations and comparisons as the above seem to me to form one of the most interesting branches of the study of bird migration; and though the observations here recorded are too few to establish any general laws, I think that similar investigations carried on for a number of years would bring to light many important facts in regard to the subject, and would perhaps show that bird migration is much more regular than is generally supposed.

NOTES ON THE BIRDS OF THE MAGDALEN ISLANDS.

BY DR. LOUIS B. BISHOP.

THE FOLLOWING list is compiled exclusively from notes taken by my friend, Mr. Robbins, and myself between June 21 and July 18, 1887. The unfavorable weather during most of this period together with the time lost in travelling among the islands probably caused us to overlook many species; but I am at a loss to account for our failure to find such birds as *Ampelis cedrorum*, *Empidonax minimus*, *Pooecetes gramineus*, and *Parus atricapillus* which were found by Mr. Cory to be tolerably common in 1878, particularly as both of us looked carefully for several of